

# MANAGEMENT OF THE UNDERWATER AND COASTAL ARCHAEOLOGICAL HERITAGE IN ISRAEL'S SEAS (I)

## GESTIÓN DEL PATRIMONIO ARQUEOLÓGICO SUBACUÁTICO Y COSTERO EN LOS MARES DE ISRAEL (I)

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### ABSTRACT

The Maritime cultural heritage of Israel reflects important chapters in the history of humanity, including the Neolithic revolution and the beginning of agriculture, the emergence of the first empires and the foundation of the three monotheistic religions. Erosion due to sea level rise and human activity is destroying important coastal and underwater archaeological sites. Low levels in the Sea of Galilee and the Dead Sea exposed many archaeological remains, which are threatened by erosion, treasure hunting and coastal development. Without intensive rescue and protection activities, the valuable cultural maritime heritage will vanish within a few decades. Legal and operational tools are currently applied in order to assure integrated coastal zone management, to control coastal development and to protect the marine cultural resources. Among these are the Antiquities Law, the Planning and Building Law, the Nature and Parks Law and the Law for the Protection of the Coastal Environment. Coastal and underwater sites are mapped and monitored, protected coastal and underwater sites are declared and rescue surveys are carried out in the endangered sites. A national risk assessment document of the coastal and underwater heritage and detailed preservation and protection plans have been prepared. Pilot projects for protecting and preserving the sea walls of Ashkelon, Apollonia and Akko were completed and several damaged harbors in the Sea of Galilee were reconstructed.

**KEY WORDS:** maritime cultural heritage; Israel's seas; management underwater heritage.

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## RESUMEN

El patrimonio marítimo cultural de Israel representa un importante capítulo en la historia de la Humanidad, incluyendo la Revolución Neolítica y los inicios de la agricultura, la aparición de los primeros imperios y la fundación de las tres religiones monoteístas. La erosión debida a la subida del nivel del mar y la actividad humana están destruyendo importantes yacimientos arqueológicos costeros y submarinos. La bajada del nivel en el Mar de Galilea y en el Mar Muerto ha expuesto muchos restos arqueológicos amenazados por la erosión, los expoliadores y el desarrollo litoral. Sin un intenso control y sin actividades protectoras se perderá el valioso patrimonio cultural marítimo en pocas décadas. Las herramientas jurídicas y operativas actualmente se están aplicando para proteger la gestión integrada de zonas costeras, para controlar el desarrollo litoral y proteger los recursos culturales marítimos. Entre estas disposiciones se encuentran la Ley de Antigüedades, la Ley de Planificación y Construcción, la Ley de Naturaleza y Parques, y la Ley para la Protección del Medio Ambiente Costero. Los yacimientos litorales y submarinos están cartografiados y supervisados, los protegidos están declarados y las actuaciones de rescate se están produciendo en los yacimientos más amenazados. Se ha elaborado un documento nacional relativo a los riesgos sobre el patrimonio litoral y subacuático, y se han detallado planes para su protección y conservación. Se han culminado los proyectos pilotos para la recuperación de las murallas marítimas de Ascalon, Apolonia y Acco, y varios puertos dañados en el Mar de Galilea se han restaurado.

**PALABRAS CLAVES:** patrimonio marítimo cultural, mares de Israel, gestión del patrimonio subacuático.

## Introduction

Coastal regions are very productive and provide diverse landscapes (estuaries, lagoons, bays, river deltas, coastal marshes, etc.) and ecological niches that may be exploited for subsistence, either by hunter-gatherers, pastoralists or agriculturalists (Fig 1). As such, coastal environments were preferred areas for human occupation since prehistory. Ancient civilizations left behind numerous remains in the sea and the coasts of Israel. Among these are: settlements inundated by the sea, ancient cities, shipwreck remains, harbors and anchorages<sup>3</sup>.

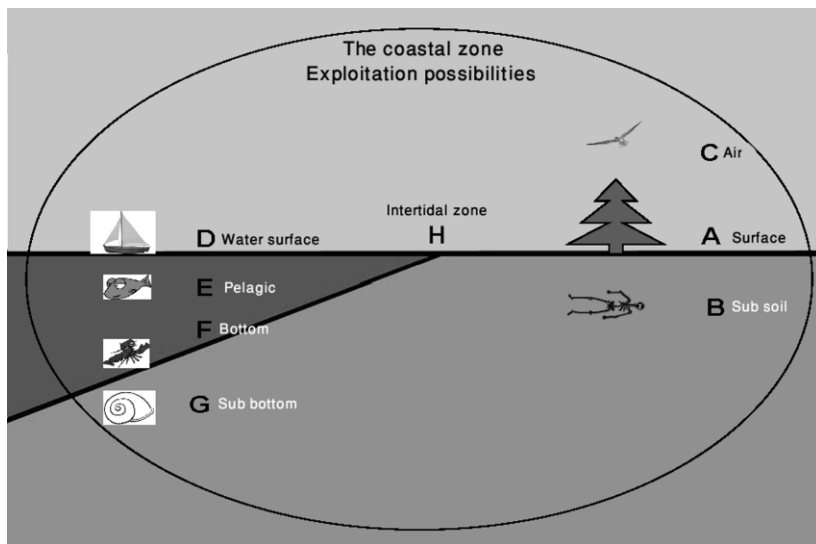


Fig.1. *Section of a tentative beach depicting the variety of ecological niches and exploitation possibilities (EG)*

These cultural assets represent important historical milestones while demonstrating continuous man – sea

<sup>3</sup> G. BAILEY, J. PARKINSON, "The Archaeology of prehistoric coastlines: an introduction", *The Archaeology of prehistoric coastlines*, G. BAILEY, J. PARKINSON (eds.) Cambridge 1988, 1-10.

interrelations. Archaeological remains discovered underwater and on shore have considerable cultural value. Artifacts recovered from shipwrecks are a testimony to a unique catastrophe occurring in the past. Unlike terrestrial sites, occupied for long periods, shipwrecks are a onetime event, a "time capsule". Most of the remains from ancient underwater sites are well preserved. They help understanding the material culture of coastal cities and their interconnections. The seabed and the shores of Israel form a vast "data bank" of ancient maritime civilizations that has yet to be studied. Marine and coastal archaeological sites can also be turned into touristic and economic assets, attracting domestic and foreign visitors. Israeli coastal cities and underwater sites have great untapped potential as parks, museums and recreation centers. Archaeological remains of the Holy Land, terrestrial and aquatic, have their origins in Judaism, Christianity and Islam. The enormous importance of these remains to humanity obliges us to treat them appropriately and preserve them and the message they bear for future generations. However, the archaeological evidence is sensitive to changes and environmental disturbances affect it negatively. Man's activities on the coast in modern times, such as quarrying, development and construction projects cause direct damage or disturb coastal sedimentation equilibrium and accelerate the erosion rates<sup>4</sup>. Sea level rise of c. 0.2 m in the 20<sup>th</sup> century has exacerbated the problem. Erosion exposed ancient remains, previously covered and protected by sand. The vanishing of sediment protection exposes underwater and coastal sites to erosion and the destructive force of the waves. Underwater archaeological sites are also endangered by treasure hunting, oil pollution and fishing (Fig. 2). If the described process continues at the current rate, most of the above-mentioned cultural assets would disappear within 10-20 years and their value to archaeology and tourism would be lost.

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<sup>4</sup> E. GALILI, B. ROSEN, "Preserving the maritime cultural heritage of the Mediterranean, a cradle of cultures, religions and civilizations - the holy land perspective", *Journal of coastal conservation and Coastal Management*, special issue 14, 2010, 303-315.

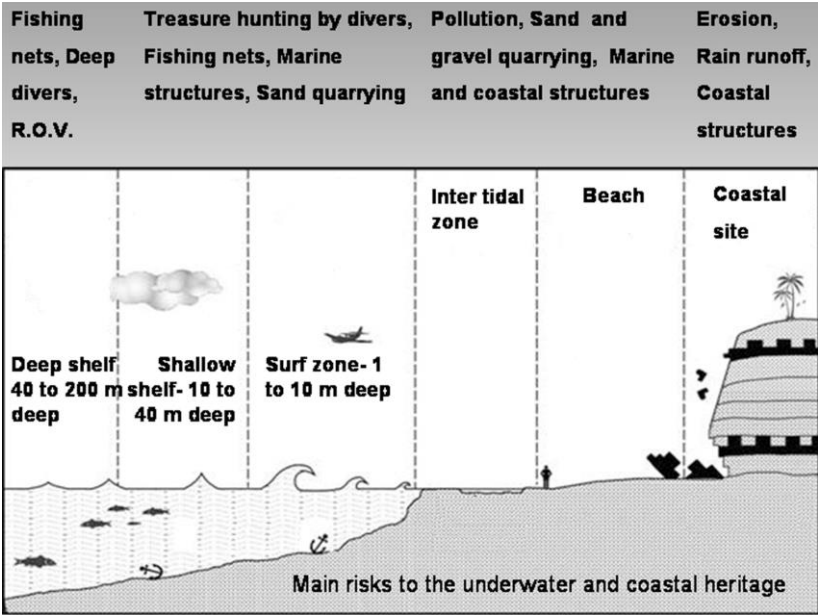


Fig. 2. *Schematic cross section of a typical beach and the possible risks to the archaeological heritage (EG)*

The Management of the underwater and coastal archaeological heritage in Israel's seas is presented in two articles: In the present article (I), we present typologically the underwater and coastal archaeological sites on the Mediterranean coast of Israel and its inland seas (Fig 3). In the second article (II), we present the harbors and anchorages in the inland seas of Israel (The Sea of Galilee and the Dead Sea), and summarize the threats that the sites are facing, the legal available tools, the institutions involved, the management tools used and the measures taken to protect the maritime archaeological heritage.

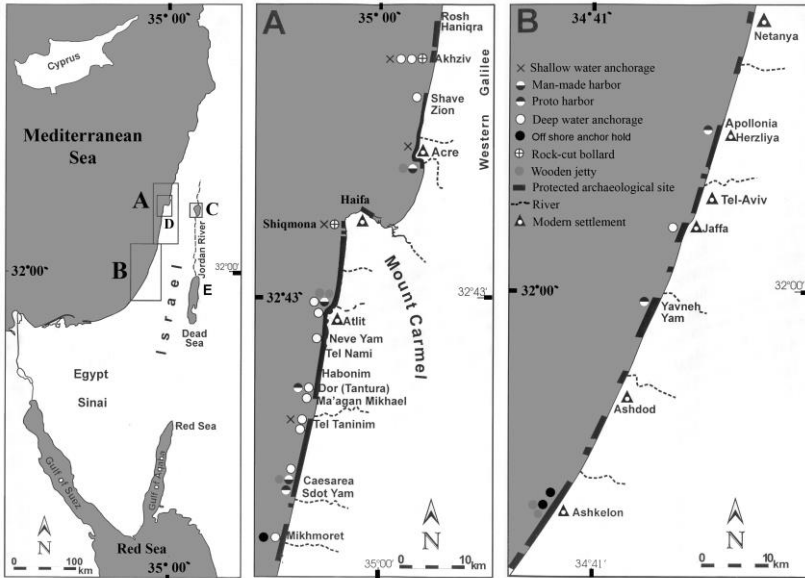


Fig. 3. *General location map-Harbors, Anchorages, submerged prehistoric settlements and protected marine archaeological sites on the Mediterranean Coast of Israel: A - northern section, B - southern section, C-the Sea of Galilee, D - The Carmel coast and Haifa bay, E -the Dead Sea (EG)*

## Typology of underwater and coastal archaeological sites in Israel's seas

The marine archaeological sites on the Mediterranean coast and inland seas of Israel are classified according to their nature, function and location (Fig. 4).

### A. Submerged prehistoric settlements

During the subsequent warming period that followed the last ice age, ice sheets melted and sea level rose significantly. About 4000 years ago, sea level reached its present level and the shoreline of Israel was finally stabilized. Former coastal prehistoric settlements on the Israeli coast were inundated and are now submerged underwater (Fig. 5).

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<b>A1:</b> Permanent settlement (Dwellings, installations, burials , structures) <b>A2:</b> Seasonal camp or activity site (Hearths, floors, installations, artifacts) <b>A3:</b> Concentration of prehistoric artifact <b>A4:</b> isolated prehistoric artifact	<b>Submerged prehistoric settlements</b>	<b>A</b>
<b>B1:</b> A wooden hull with, or without, cargo <b>B2:</b> A pile of cargo and artifacts with some hull remains <b>B3:</b> Assemblage of a wrecked vessel lacking wooden hull (concentration of artifacts usually in 3-4 m water depth originated from a grounded ship that wrecked in the breaker zone) <b>B4:</b> concentration, or pile of similar anchors originating from one wreckage event, usually a grounded ship as in B3 <b>B5:</b> Whole and broken amphorae of the same type scattered in deep water (30-80m) spread by trawlers, originated from a shipwreck or a jettison <b>B6:</b> A single artifact out of context but presumably originated from a watercraft <b>B7:</b> A single anchor probably lost while anchoring <b>B8:</b> A pile of ballast stones, probably jettison <b>B9:</b> Pre-modern and modern metallic wrecks (ships, submarines, aircrafts)	<b>Shipwrecks and other wrecks</b>	<b>B</b>
<b>C1:</b> Man-made harbor, built at sea and/or on the coast and/or inland (breakwaters, wharfs) <b>C2:</b> Proto harbor natural anchorage (3-7 m depth) usually a small partly-sunken kurkar ridge, with some man - made modifications <b>C3:</b> Deep-water (3-7 m depth) natural anchorage, usually a small partly sunken kurkar ridge <b>C4:</b> Shallow water natural anchorage (1-2m depth) <b>C5:</b> offshore anchor hold (submerged rock in the Mediterranean and artificial stone mound in the inland seas) <b>C6:</b> bollards or mooring holes <b>C7:</b> slipway <b>C8:</b> Isolated wooden wharf or jetty <b>C9:</b> Isolated stone – built marine structure (jetty, wharf) <b>C10:</b> Harbor in the inlet of a coastal river	<b>Harbors, anchorages, mooring and hauling facilities</b>	<b>C</b>
<b>D1:</b> Rock- cut pools operated with sea water by gravity (for keeping or raising marine life) <b>D2:</b> Coastal fresh water installations (pools fed with fresh water, wells, aqueducts) <b>D3:</b> Rock cut installation for salt production (sea water well, lifting slope, lifting channel) <b>D4:</b> Coastal quarry <b>D5:</b> Rock-cut wave trap, wave protection <b>D6:</b> Architectural element that felled to the sea from an eroded/collapsed coastal site <b>D7:</b> Sewer and drainage outlet partly submerged <b>D8:</b> Foundations of buildings and structures partly submerged <b>D9:</b> Sea walls and fortifications reaching or entering the sea <b>D10:</b> Coastal settlement from historical periods, partly submerged, or abraded by the sea <b>D11:</b> Grave from historical periods, partly submerged, or abraded by the sea	<b>Coastal rock-cut or stone – built structures and installations</b>	<b>D</b>

Fig. 4. *Typology of underwater and coastal archaeological sites in Israel's seas. The typology is based on Galili and Sharvit (1994), with some additions and changes (EG)*

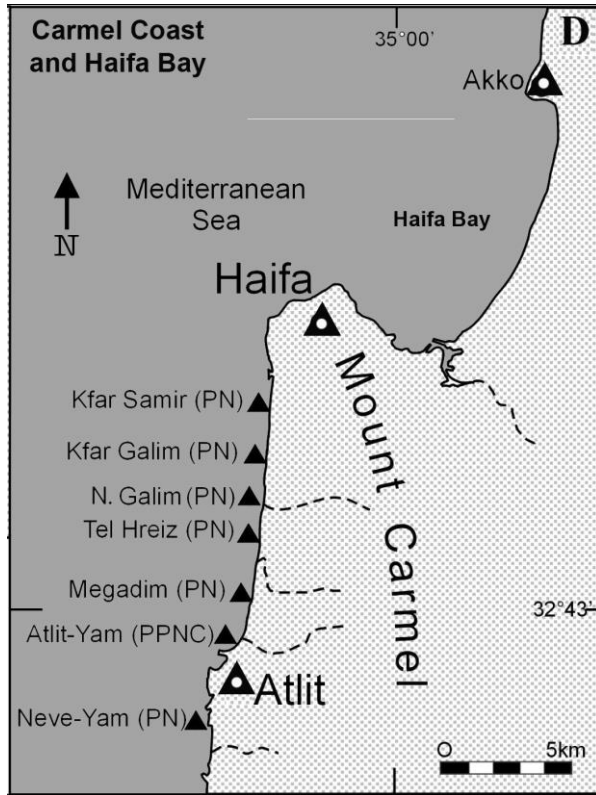


Fig. 5. Location of the submerged prehistoric settlements off the Carmel coast (insert from Fig. 3D)(EG)

## B. Shipwrecks

Because of the physical characteristics of the Israeli Mediterranean coastline (lack of natural shelters and unexpected storms), and the harsh sea conditions in the inland seas, many ships were wrecked and washed ashore. Hence, many ships were grounded during storms and most of the shipwrecks are currently concentrated close to the shoreline. Most of the shipwrecks recovered (a few hundreds) consist of anchors and associated assemblages of artifacts scattered on the sea bed with no hull remains. About 15 shipwrecks contained wooden hulls, most of

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them were located in the partly protected anchorages of Akko and Dor. Most of the hull containing shipwrecks were left in situ, some of them after excavation and documentation. The only shipwreck which was fully excavated, retrieved, preserved and displayed in a museum is the Ma'agan Michael shipwreck<sup>5</sup>. A full size replica of this ship is currently being constructed. The shipwrecks which are found in the region can be classified as follows:

*B.1. Remains of a wooden hull and cargo:* such wrecks are usually found in sheltered areas that are protected by submerged or partly submerged *Kurkar* ridges (Caesarea north anchorage, Ma'agan Mikhael anchorage, Dor anchorage and Acre anchorage). Some of these ships were wrecked while anchoring and waiting for favorable winds.

*B2:* A pile of cargo and artifacts with some hull remains.

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*B.3. Assemblage of vessel lacking wooden hull:* this is the most common kind of shipwreck along the Israeli coast. These assemblages are usually found in open and unprotected coasts, some 70-150 m. offshore, in the breaker zone at water depths of 2-4 m. Most of these ships grounded and wrecked during winter storms.

*B4:* Concentration, or a pile, of similar anchors originating from a single wreckage event, usually from a grounded ship, as in B3 above.

*B.5. Scattered pottery vessels in deep water (25-45m):* most of these vessels are found whole, some of them were probably dumped by

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<sup>5</sup> E. LINDER, "Excavating an Ancient Merchantman", *Biblical Archaeology Review* (Biblical Archaeology Society) 18 (6), 1992, 24-32, 24-35.

the mariners after consuming the contents, or jettisoned in cases of emergency, while others may have originated from wrecked vessels that were scattered on the sea bottom by modern trawling activities.

*B.6. Single isolated artifact originating from a ship:* artifacts that were intentionally or unintentionally dumped into the sea by the ancient mariners. These artifacts cannot be associated with a wreckage event or with a particular archaeological assemblage.

*B.7. A single anchor that was probably lost while anchoring or deliberately abandoned at a case of emergency.*

*B.8. Concentration of ballast stones:* usually piles of non-local stones, surrounded by scattered artifacts, nails, ship's fittings and anchors.

*B.9. Pre modern and modern (usually metallic) wrecks (ships, aircraft, submarines):*

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The 19<sup>th</sup> and 20<sup>th</sup> centuries civilian activity and military operations have left many wrecks associated with world wars I and II and other local conflicts. These wrecked vessels and lost aircraft are often considered as underwater cultural and national heritage and should be documented, studied, preserved and protected<sup>6</sup>.

### **C. Harbors and anchorages**

The southern Mediterranean coast of the Levant and the inland seas of Israel (Sea of Galilee and the Dead Sea) have been busy seaways for the past five millennia. Ancient coastal settlements engaging in commerce and shipping were founded

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<sup>6</sup> E. GALILI, F. RUBERTI, R. WALDING, "The Italian Submarine Scire and the maritime struggle in the Mediterranean during WWII", *Archaeologia Maritima Mediterranea* 10, 2014, 95-124.

along these coasts since the Early Bronze Age<sup>7</sup>. Along Israel's Mediterranean coast and inland seas, there is a variety of ancient harbors and natural anchorages (Fig 3). The three outstanding man-made harbors on the Mediterranean coast of Israel are: Caesarea – one of the largest Roman ports of the Mediterranean (Fig. 6); Atlit – a well preserved Phoenician harbor (Fig. 7); and Acre (Akko), a living, functioning Mediterranean city with an ancient harbor that has been preserved, renovated and is now used by fishing and pleasure craft (Fig. 8)<sup>8</sup>. The Mediterranean coast of Israel (c.188 km long) is straight, with no islands or bays to provide shelter for watercraft during heavy storms. During the Bronze Age, before the construction of built harbors, a series of natural anchorages were used for temporary shelter. On the coastal plain there are several *kurkar* (sandstone) ridges running parallel to the shore. Some of these ridges are partly submerged, forming small islets and discontinuous reefs some 150 to 600 m offshore that may provide partial protection to anchoring vessels. The shortage of natural shelters along the coast and the strong winter storms were a problem for local seafarers. Various solutions to the shelter problem were applied, and are

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<sup>7</sup> A. RABAN, "The ancient harbours of Israel in Biblical times", *Harbour Archaeology: Proceedings of the First International Workshop on Ancient Mediterranean Harbours, Caesarea Maritima, 24–28 June 1983*. BAR International Series, S257, A. RABAN (ed.) Oxford 1985, 11–44.

<sup>8</sup> A. RABAN, *The Harbors of Sebastos (Caesarea Maritima) in its Roman Mediterranean context*. BAR international series 1930, M. ARTZI, B. GOODMAN, Z. GAL (eds). Oxford 2009; H. ARAD, "Harbors in Phoenicia, Israel and Philistia in the 9th–7th Centuries BCE: Archaeological Finds and Historical Interpretation", *Rekanati Institute for Maritime Studies (RIMS) news* 35, 1999, 33–37; E. GALILI, B. ROSEN, D. ZVIELY, N. SILBERSTEIN, J. FINKIELSZTEIN, "The Evolution of the Akko harbour and its trade links revealed by recent underwater and coastal archaeological research", *Journal of Island and coastal Archaeology* 5, 2010, 191–211; E. GALILI, "Ancient harbours and anchorages along the Israeli coast after five decades of underwater and coastal research", *Kadmoniot* 327, 2009 (Hebrew).

demonstrated by the typology of the ports and anchorages described below<sup>9</sup>.



Fig. 6. *The Roman harbor of Caesarea (modified by EG after aerial photo of the Survey of Israel and Arenson S. brochure of the underwater park of Caesarea harbor)*

*C1. Man-made (built-up) harbor:* quays, breakwaters, jetties, etc. Such facilities were usually constructed by the ruling authorities since the Persian period. Three such harbors were found at Acre, Atlit and Caesarea.

*C2. Proto-harbor (3-7 m water depth):* a sheltered area, usually situated at the lee side of a *kurkar* ridge, which is partly submerged at some distance offshore, with some man-made improvements. Such anchorages were used since the Middle Bronze-Age by sea-going vessels for overnight anchoring and/or waiting for favorable sailing winds. Remains of such features were recorded at Caesarea, Apollonia, Yavneh-Yam and Tel Ridan.

*C3. Deep-water (3-7 m water depth) natural anchorage:* Usually a *kurkar* ridge, which is partly submerged, forming small islet offshore.

<sup>9</sup> E. GALILI, J. SHARVIT, "Classification of Underwater Archaeological Sites along the Mediterranean Coast of Israel: Finds from Underwater and Coastal Archaeological research", *Thracia Pontica* 5, 1991, (1994), 269-296.

This type of anchorage was used as early as the Middle Bronze Age. Its functions were similar to those of Type B2 above. Such anchorages have been found at Akhziy, Shavey-Zion, Atlit, Neve-Yam, Dor, Ma'agan-Michael, Tel-Taninim (Zarka), Caesarea, Michmoret and Jaffa.



Fig. 7. Top: The Atlit peninsula: A-reconstruction of the Crusader fortress (modified by Ben Galili after Dr. Cleve), B – reconstruction of the 9<sup>th</sup> century BC harbor, C, D – the breakwaters, Bottom: the harbor today (EG)

*B4. Shallow-Water Natural Anchorage (1-3 m water depth):* a shelter created by small natural features close to the coastline. This type of anchorage usually utilizes minor bays and abrasion platforms which were used for anchoring fishing boats and lighters. Traditional fishermen currently use similar features at Zarka, Shiqmona (south of Haifa), Acre and Akhziv.

*B5. Off shore anchor hold:* submerged *kurkar* ridge, located some 300-600 m offshore, with its peak lying at 4-12 m beneath sea level. Features like this provided an optimal holding ground for ancient stone anchors. Ancient vessels chose such places for anchorage in areas where no shelters or port facilities were available and the sea bottom was silty or sandy. Two anchorages of this type have been found, one in Ashkelon, off the southern coast of Israel and one off Mikhmoret (central Israel). In the inland seas (the Sea of Galilee and the Dead Sea) off shore, anchor holds were constructed from boulders.



Fig. 8. *Akko traditional city and port (EG).*

*B6. Rock-cut mooring facility (bollards, mooring holes and upright columns):* In the southeastern corner of Akhziv Bay, two round bollards are cut in the *kurkar* rock about three meters from the coastline. Six similar bollards are cut into the coastal limestone of a small bay south of Shiqmona (Fig. 9). It seems that these bollards were used for mooring vessels in order to unload heavy cargo (stone architectural elements for example) by dropping them into the sea close to the coast and dragging them ashore. Secondary used columns were inserted upright in the rocky coast of Dor (North Bay) and in the southern breakwater at Akko harbor.



Fig. 9. Rock cut pool for keeping *murex* shells intended for the purple dye industry in Shiqmona (EG).

*B7. Slipway:* In the north section of Tel Dor, three surfaces were cut into the *kurkar* rock, above the abrasion platform, trending northward towards the sea at an angle of 5 degrees. These rock-cut installations may have served as slipways or as dry docks dating to the Classical period.

*B8. Wooden wharf or jetty:* Two wooden jetties, one close to the coast and another some 130 m offshore were recovered and

documented opposite tell Ashkelon, Two such facilities were recovered in the north Bay of Atlit and one at the entrance to Akko Harbor.



Fig. 10. *Sea water well used as a pumping station for the production of salt, Habonim, Carmel coast (EG)*

*B9. Isolated stone built marine structures (wharfs, jetties, docks):* A jetty built from pierced rectangular stones and a small dock built of ashlar were recovered in Caesarea south anchorage.

*B10. Harbor at the inlet of a coastal river:* It was suggested that river courses served as inland harbors for sea-going ships during the Bronze Age<sup>10</sup>. However, the possibility that sea-going vessels

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<sup>10</sup> A. RABAN, "The ancient harbours of Israel in Biblical times", *Harbour Archaeology: Proceedings of the First International Workshop on Ancient Mediterranean Harbours, Caesarea Maritima, 24–28 June 1983*. BAR International Series, S257, A. RABAN (ed.) Oxford, 1985, 11–44.



used such river courses as inland harbors is still being debated. In Nahal Hadera, south of Caesarea, a dock built from ashlar headers was recovered on the south bank of the river few hundreds m. inland and was reconstructed. In the Sea of Galilee and the Dead Sea, river outlets were used for sheltering small vessels (Fig 11).

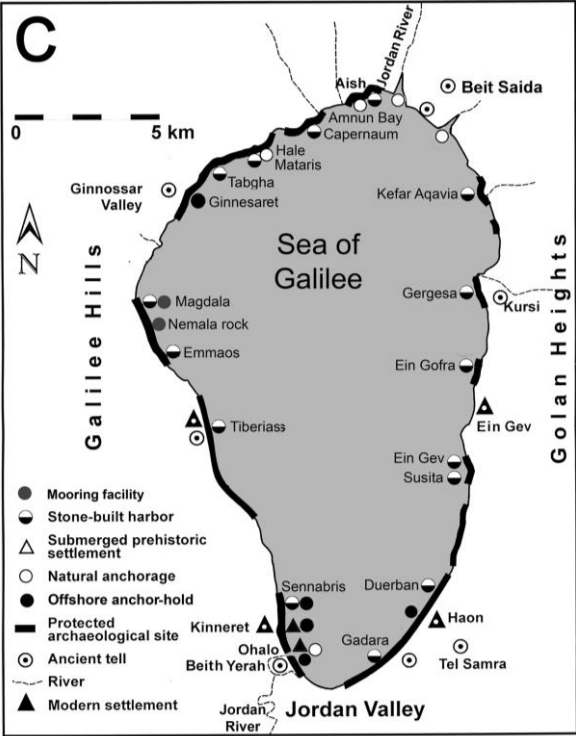


Fig. 11. Harbors, Anchorages and protected marine archaeological sites on the Sea of Galilee (EG)

#### D. Coastal rock-cut installations and shoreline constructions

*D. 1. Rock cut pools operated with sea water by gravity:* Tens of pools of various shapes and sizes were observed on the coastline of

Northern Israel (between the Western- Galilee and Caesarea) and a few in central and southern Israel. The pools are usually cut into the coastal rocks, at sea-level or slightly lower, to allow water supply by gravity. It seems that some of the pools were used for bathing, while others, for keeping live fish or Murex-shells (intended for producing purple-dye). At least one, at Akhziv, was fashioned as a true fishpond for aquaculture.

*D2. Coastal fresh water installation (A pool fed with fresh water source, well, aqueduct)*

*D3. Rock cut installations for producing salt*

The topography of the Carmel coast in the area between Atlit and Dor, is suitable for producing salt from seawater. The elongated troughs behind the shore, which are almost at sea level elevation, are filled with impermeable clay sediments which can hold water, and are suitable for salt-pans. The rocky coastline allows the hewing of rock-cut installations of various types in order to transfer water from the sea eastward to the evaporation pans in the troughs. Rock-cut installations intended for producing salt were located during coastal surveys in the Carmel coast<sup>11</sup> (Fig. 10). These structures are directly associated with the sea and provide valuable information about sea level changes and coastline displacement. Judging by the available data revealed from the rock-cut installations on the Israeli coast, it seems that no major tectonic or eustatic changes have occurred in the region during the last 2000 years.

*D4. Coastal quarry partly submerged at the intertidal zone*

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<sup>11</sup> E. GALILI, B. ROSEN, "Atlit, Salt Production Installations on the Carmel and Western Galilee Coasts, Survey", *Hadashot Arkhaeologiot* 127, 2014, n.p.

*D5. Rock –cut wave trap on the abrasion platform:* Such protection against the waves were cut in the Kurkar stone on the sea front of coastal cities of Dor and Akko,

*D6. Architectural elements originating from collapsed coastal sites:*

*D7. Sewer and drainage outlet partly submerged:*

*D8. Foundations of buildings and structures partly submerged:*

*D9. Sea walls and fortifications reaching or entering the sea:*

*D10. Coastal settlement from historical times partly submerged or eroded by the sea:*

*D11. Graves from historical times partly submerged or eroded by the sea:*

## **Harbors and anchorages in the inland seas of Israel**

The Sea of Galilee is a fresh water body of water in northern Israel (Fig 11) and the Dead Sea is a hyper-saline desert lake located at southern Israel at the lowest terrestrial place on Earth (Fig. 3). These two inland lakes are located in the Jordan rift valley some 60 and 100 km inland from the Mediterranean coast respectively. The shores of these lakes were settled by man since prehistory and were associated with regional and even wider events of historical, cultural and religious importance. As such, the nature of maritime activity on these lakes is of interest.

In the Sea of Galilee two series of droughts during the years 1999-2011 resulted in exceptionally low lake levels reaching 213-214.87 m below sea level, about 6 m lower than the highest possible level. In the Dead Sea, the drying out of the lake from the 1960s (399 m below sea level) onward resulted in a reduction of ca 30 m. down to 428 n below sea level during 2014. The drying of the lake continues today at an average rate of more than

1 m per year. Consequently, wide areas of the former lake-beds have been exposed, revealing numerous ancient artificial constructions and various archaeological finds. This situation enabled the discovery of many archaeological sites, but also resulted in the destruction of sites due to erosion, treasure hunting and development activities. Systematic ongoing surveys of these areas were carried out in the framework of the Dead Sea Coastal Survey and The Israel Antiquities Authority rescue surveys. The surveys aimed at locating, recording, retrieving, studying and publishing newly exposed finds on the former beds of these inland seas. The rescue surveys have revealed numerous finds directly linked to ancient and historic maritime activity on the Dead Sea and The Sea of Galilee.



Fig. 12. *Tabgha harbor before it was damaged by coastal development (Mendel Nun)*

The unique geomorphological and climatic conditions in the Sea of Galilee and the Dead Sea influenced the nature of mooring facilities. The un-indented coasts, scarcity of natural shelters and the sudden onshore winds required the construction of artificial shelters and mooring aids for water craft. However, unpredictable multiyear water level changes of up to several m made it difficult to plan, construct and maintain long lasting harbors. The mega-changes in these lakes levels (reaching about 6 m in the Sea of Galilee and ca 30 m in the Dead Sea) made the construction of long lasting harbors problematic and unjustified

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economically. This situation led to the development of local solutions to facilitate anchoring and safe mooring for water craft, when needed. Small water craft which could be easily hauled ashore, were most probably pulled out of the water, manually or using simple winches. Bigger vessels had to rely on the relatively scarce natural features (small bays, river inlets) or different types of manmade facilities (built harbors, mooring facilities and offshore anchor holds). In the Sea of Galilee, small, "ad hock" harbors were built to provide shelter for water craft (Fig. 11). They were built of local undressed boulders, according to the lake level at the time of construction, with minimal investment. They were often abandoned or modified following changes in lake – levels, which made them useless. Such harbors were reported from: Aish, Capernaum, Tabgha (Fig. 12), Gennesaret, Magdala, Emmaus, Sennabris, Beith Yerah, Gadara, Susita, Ein Gev, Ein Gofra, Gergesa, Kfar Aqavya<sup>12</sup>. Another method of coping with the lack of shelters and onshore winds on the Sea of Galilee and the Dead Sea was the construction of submerged offshore stone mounds, to provide anchor holds and prevent water craft from being washed ashore by on-shore winds. These anchor holds could have functioned in various lake levels, as long as they were partially or totally flooded and could have also been used as fish nurseries. Several such man-made mounds were exposed in the Sea of Galilee during a low lake-level event in November 2001 at Moshava Kinneret, Tell Beith Yerah, Kibbutz Ginnosar, and Kibbutz Haon. Another mound was recently reported from Sennabris<sup>13</sup>. They were classified as open water anchor holds and/or fish nurseries. On the north Dead Sea shore (Fig. 13) two

<sup>12</sup> M. NUN, *Ancient Anchorage and Harbours around the Sea of Galilee*, Kinneret Sailing Co., Ein. Gev. 1988. E. GALILI, A. RABAN, J. SHARVIT, "Forty Years of Marine Archaeology in Israel", *Tropis* 7, 1999 (2002), 927-961; E. GALILI, J. SHARVIT, "The Sea of Galilee, Coastal and Underwater Surveys", *Hadasot Arkheologiyot* 114, 2002, 17–18.

<sup>13</sup> Y. PAZ, R. MOSHE, B. ZVI, M. SHMUEL, G. TIBOR, D. NADEL, "A Submerged Monumental Structure in the Sea of Galilee, Israel", *International Journal of Nautical Archaeology* 42, 2013, 189-193.

such stone mounds were recently reported as off shore anchor holds<sup>14</sup>.

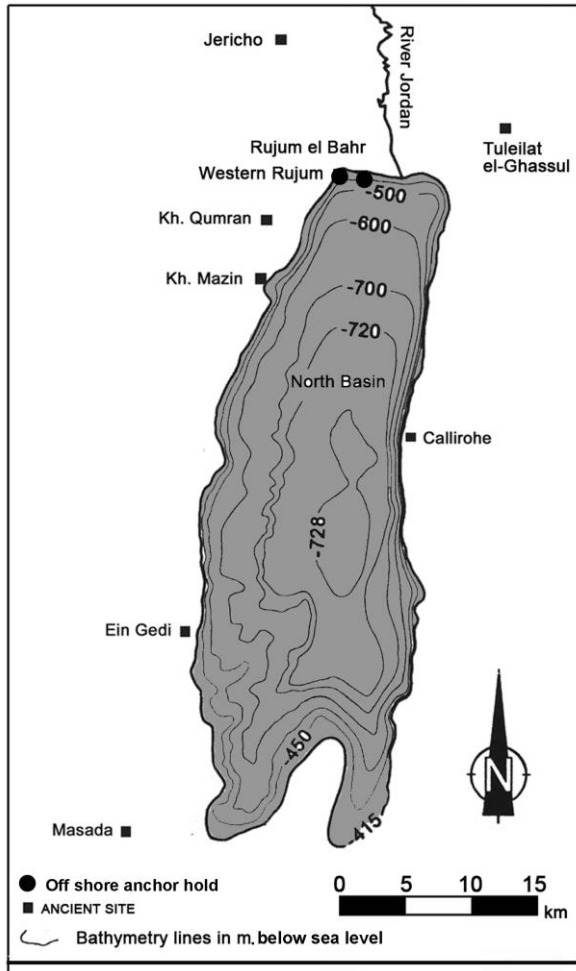


Fig. 13. The north basin of the Dead Sea with the location of the two offshore anchor holds on the northern coast (Modified by EG after Oron et al. 2014, for location see Fig 3E)

<sup>14</sup> A. ORON, E. GALILI, G. HADAS, M. KLEIN, "Two Artificial Anchorages off the Northern Shore of the Dead Sea: A Unique Feature of an Ancient Maritime Cultural landscape", *The International Journal of Nautical Archaeology* 2014.

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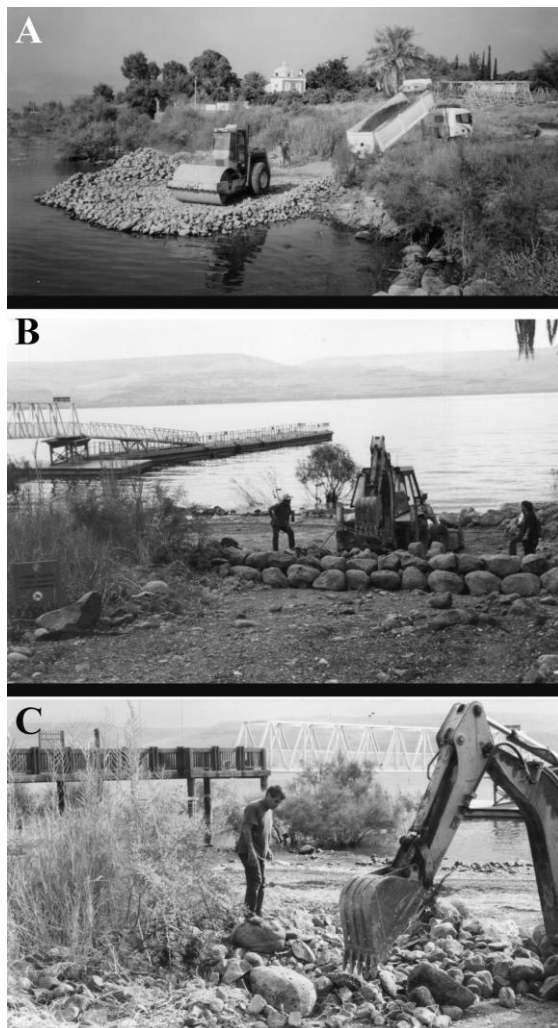


Fig. 14. *Capernaum harbor: A- Damage to the harbor during coastal development, B, C – reconstructing the damaged harbor (EG)*

Many of these sites are endangered now because of the exceptionally low lake levels in modern times, which have required modification of coastal facilities to enable access to the new water line. The growing demand for coastal facilities and

tourist attractions resulted in intensified, uncontrolled, unplanned and in many cases illegal, building and construction activities along the lake shore. This combination caused a massive, rapid destruction of 5 ancient harbors within a few years (Capernaum, Tabgha, Ein Gev, Ein Gofra and Kfar Akavya). In these sites the Israel Antiquities Authority demanded and applied corrective and reconstructive activities. Using archival photographs and plans, the destructed harbors were rebuilt, identical as possible to the original ones and using the local stones (Fig. 14).

The low lake levels also resulted in massive treasure hunting activity. Ongoing low enforcement carried out by The Israel Antiquities Authority year round aimed at preventing such treasure hunting (Fig. 15).



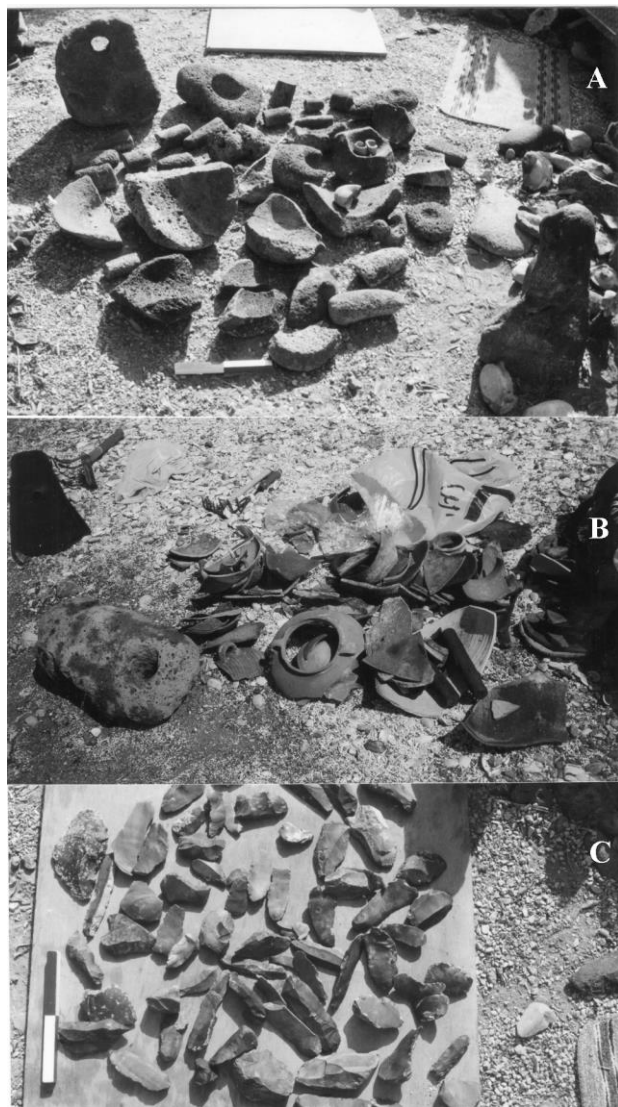


Fig. 15. *Artifacts systematically collected by treasure hunters during low levels of the Sea of Galilee and captured by the : A- Ground stone assemblage from Tell beith Yerab, B- Pottery vessels and stone anchor from Ein Gev harbor, C- Flint artifacts from the Upper Paleolithic submerged site Ohalo 1 (EG)*

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